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PTO/SB/05 (12/97)
Approved for use through 09/30/00. OMB 0651-0032
Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b)

Attorney Docket No. 042390.P5112 Total Pages 2

First Named Inventor or Application Identifier David Horne

Express Mail Label No. EM441200223US

ADDRESS TO: **Assistant Commissioner for Patents**
Box Patent Application
Washington, D. C. 20231

APPLICATION ELEMENTS
See MPEP chapter 600 concerning utility patent application contents.

1. X Fee Transmittal Form
(Submit an original, and a duplicate for fee processing)

2. X Specification (Total Pages 12)
(preferred arrangement set forth below)
- Descriptive Title of the Invention
- Cross References to Related Applications
- Statement Regarding Fed sponsored R & D
- Reference to Microfiche Appendix
- Background of the Invention
- Brief Summary of the Invention
- Brief Description of the Drawings (if filed)
- Detailed Description
- Claims
- Abstract of the Disclosure

3. X Drawings(s) (35 USC 113) (Total Sheets 4)

4. X Oath or Declaration (Total Pages 5)

a. X Newly Executed (Original or Copy)

b. ___ Copy from a Prior Application (37 CFR 1.63(d))
(for Continuation/Divisional with Box 17 completed) **(Note Box 5 below)**

i. ___ DELETIONS OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).

5. _ Incorporation By Reference (useable if Box 4b is checked)
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

6. _ Microfiche Computer Program (Appendix)

PTO/SB/17(10/96)
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FEE TRANSMITTAL

TOTAL AMOUNT OF PAYMENT ($) 830.00

Complete if Known:
Application No. _____
Filing Date _____
First Named Inventor David Horne
Group Art Unit _____
Examiner Name _____
Attorney Docket No. 042390.P5112

METHOD OF PAYMENT (check one)

1. [X] **The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:**

   Deposit Account Number 02-2666
   Deposit Account Name _____

   [ ] **Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17**

   [ ] **Charge the Issue Fee Set in 37 CFR 1.18 at the Mailing of the Notice of Allowance, 37 CFR 1.131(b)**

2. X **Payment Enclosed**
   X **Check**
   __ **Money Order**
   __ **Other**

FEE CALCULATION (fees effective 10/01/97)

1. **FILING FEE**

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	790	201	395	Utility application filing fee	$790.00
106	330	206	165	Design application filing fee	
107	540	207	270	Plant filing fee	
108	790	208	395	Reissue filing fee	
114	150	214	75	Provisional application filing fee	

SUBTOTAL (1) $ 790.00

2. **CLAIMS**

		Extra		Fee from below		Fee Paid
Total Claims	11 – 20 =	0	X		=	
Independent Claims	1 – 3 =	__	X		=	0
Multiple Dependent Claims		__	X		=	

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
103	22	203	11	Claims in excess of twenty	
102	82	202	41	Independent claims in excess of 3	
104	270	204	135	Multiple dependent claim	
109	82	209	41	Reissue independent claims over original patent	
110	22	210	11	Reissue claims in excess of 20 and over original patent	

SUBTOTAL (2) $ 0

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge - late filing fee or oath	
127	50	227	25	Surcharge - late provisional filing fee or cover sheet	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for response within first month	
116	400	216	200	Extension for response within second month	
117	950	217	475	Extension for response within third month	
118	1,510	218	755	Extension for response within fourth month	
128	2,060	228	1,030	Extension for response within fifth month	
119	310	219	155	Notice of Appeal	
120	310	220	155	Filing a brief in support of an appeal	
121	270	221	135	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive unavoidably abandoned application	
141	1,320	241	660	Petition to revive unintentionally abandoned application	
142	1,320	242	660	Utility issue fee (or reissue)	
143	450	243	225	Design issue fee	
144	670	244	335	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Petitions related to provisional applications	
126	240	126	240	Submission of Information Disclosure Stmt	
581	40	581	40	Recording each patent assignment per property (times number of properties)	
146	790	246	395	For filing a submission after final rejection (see 37 CFR 1.129(a))	
149	790	249	395	For each additional invention to be examined (see 37 CFR 1.129(a))	

Other fee (specify) Assignment 40.00

Other fee (specify) _____

SUBTOTAL (3) $ 40.00

*Reduced by Basic Filing Fee Paid

SUBMITTED BY:

Typed or Printed Name: David R. Halvorson

Signature _____ Date 11/5/98

Reg. Number 33,395 Deposit Account User ID _____ (complete if applicable)

PTO/SB/17 (10-96)
Approved for use through 09/30/98 OMB 0651-0032
Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Docket No. 043290.P5112

United States Patent Application for

A METHOD FOR USING CODEBOOK INDEXING TO ACHIEVE HIGH BIT DENSITIES IN A DIRECT-SEQUENCE CDMA SPREAD SPECTRUM COMMUNICATION SYSTEM

Inventors: David Horne

Prepared by:

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"Express Mail" mailing label number: EM441200223US
Date of Deposit: January 5, 1998
I hereby certify that I am causing this paper or fee to be deposited with the United States Postal Service "Express Mail Post Office to Addressee" service on the date indicated above and that this paper or fee has been addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231

Lori Cox
(Typed or printed name of person mailing paper or fee)

Lori Cox
(Signature of person mailing paper or fee)

1/5/98
(Date signed)

FIELD OF THE INVENTION

The present invention relates to the field of data communications. More particularly the invention describes a method of using codebook indexing to achieve high bit densities in direct sequence CDMA spread spectrum communication systems.

BACKGROUND OF THE INVENTION

Direct Sequence Spread Spectrum (DSSS) techniques rely on the use of pseudo-noise carriers, also called spreading codes, spreading sequences, code sequences and chip sequences, and a transmission bandwidth which is much wider than the minimum required to transmit the information. The transmitter spreads the information by modulating the information with a pseudo-noise spreading sequence. At the receiver, the information is despread to recover the base information. This despreading is accomplished by correlating the received, spread-modulated, signal with the spreading sequence used for the transmission. DSSS is sometimes referred to by the shorthand name "direct spread."

The modulating signal, such as a pseudo-random spreading code signal, possesses a chip rate (analogous to carrier frequency) which is much larger than the data rate of the information signal. This characteristic is required for efficient spreading. Each state of the pseudo-random spreading sequence is referred to as a chip. The spreading sequence (chip sequence) directly modulates each bit of the information signal, hence the name direct spread. Pseudo-randomness of the spreading signal is required in order to recover the original information signal. Since the spreading sequence is deterministic, it can be exactly duplicated

at the receiver in order to extract the information signal. If it were truly random, extraction of the information signal via correlation receiver would not be possible.

The spreading operation causes the signal power to be depleted uniformly across the spread bandwidth. Thus, the spread spectrum signal will appear buried in noise to any receiver without the despreading signal. Consequently, it is not only difficult to jam, but is also difficult to detect its presence in any bandwidth. Any undesired signal picked up during transmission is spread by the receiver in the same way that the transmitter spread the desired signal originally. In other words, the receiver spreads undesired signals picked up during transmission, while simultaneously despreading, or demodulating, the desired information signal. Processing gain is the term used to express this interference suppression in the overall transmit/receive operation. When viewed as a transmit/receive operation, the desired signal is spread-modulated twice, giving back the original signal, while in-band interference is spread-modulated once, and thereby depleted across the full spread bandwidth.

CDMA Direct Spread is an adaptation of conventional Direct Spread which accommodates multiple simultaneous access through the use of mutually orthogonal spreading codes. Mutually orthogonal means the cross correlation of any spreading code in the set is small (ideally zero). In an ideally orthogonal system, orthogonality not only means that there is no mixing of signals, but it also means that there is no interference between signals. In practice, the number of multiple access users cannot increase without bound because each user signal contributes a small multiple access interference component due to deviations from ideal. Since the receiver detection margin is not infinite, an eventual limit is reached.

SUMMARY OF THE INVENTION

A method for achieving high bit densities in a direct-sequence CDMA spread spectrum communication system. A table of orthogonal pseudo-noise codes is stored. This table is then partitioned into multiple codebooks. Then, each codebook is assigned to a user. The pseudo-noise codes contained within the codebooks are used to spread information signal. Information signal for a first user is spread by a pseudo-noise code contained within the codebook assigned to the first user. Multiple bits of information signal may be sent at a time by using the location of the pseudo-noise code within the codebook such that the value of the information signal corresponds the location of the pseudo-noise code within the codebook. The information signal is then despread by using the same pseudo-noise code.

Docket No. 95-0454

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is illustrated by way of example and not limitation in the figures of the accompanying drawings, in which like references indicate similar elements and in which:

Figure 1(a) is a diagram showing a signal being spread.

Figure 1(b) is a diagram showing a spread signal with interference being demodulated into the original signal and noise.

Figure 2(a) is an exemplary prior art method of spreading signals.

Figure 2(b) is an exemplary method of spreading signals using codebook indexing.

Figure 3 is diagram of a pseudo-noise code table partitioned into multiple codebooks.

Figure 4 is a diagram showing a method of spreading signals for three users using the codebook indexing of the table of figure 3.

DETAILED DESCRIPTION OF THE INVENTION

The disclosed technique utilizes a previously unexploited grouping of orthogonal spreading codes into fixed codebooks for each user signal. By direct-spreading with a data dependent spreading code, where this spreading code is an indexed-member of a fixed-size codebook, the information capacity of the transmitted signal is increased over conventional direct sequence spread spectrum techniques. This information capacity increase is achieved with virtually no change in transmit power or bandwidth. Implementation is relatively simple and does not alter the orthogonality properties at the receive since all codebook entries with a codebook, and among multiple codebooks, are derived from an orthogonal set. Codebook size can be traded off for implementation resources, number of multiple access channels desired, and data rate differences between the multiple access channels.

By grouping a large orthogonal spreading code set into smaller codebooks, with each user signal assigned a unique codebook, multiple bits can be conveyed within each symbol period for each user signal. This grouping, together with the data-dependent index into the codebook results in conveying an additional 'n' bits per symbol, where 'n' is the log-base-2 of the codebook size. Additionally, since each codebook is a distinct subset of the full orthogonal code set, multiple access capability is possible. Multiple user signals are each spread by a distinct set of orthogonal codes from the codebook assigned to a given user signal.

Figure 1(a) shows an example of what occurs to a signal when it is spread. Signal 100 is spread using a spreading sequence (not shown) into signal 101. As can be seen, the amplitude of the signal is decreased, while its bandwidth is expanded. By reducing the amplitude, the signal will appear indistinguishable from noise, and can only be recovered by a

receiver which processes the correct spreading sequence. Figure 1(b) shows the spread signal 101 and an interference signal 102 which has been picked up during transmission. When the spread modulated signal 101 is demodulated by using the original spreading sequence (not shown), the original signal 100 is recovered and the interference signal 102 is spread into signal 103, thereby being reduced to noise.

Figure 2(a) is a diagram of an exemplary prior art method of spreading a signal. An information signal 210 is modulated, using known methods, by a pseudo-noise code 211. For each '1' in the information signal, the pseudo-noise code 211 is transmitted. Whereas for each '0' in the information signal, the inverse of the pseudo-noise code 211 is transmitted. Thus, through such modulation, the signal is spread out for transmission into the transmitted signal 212. For example, if the information signal 210 consists of the bits '101' and the pseudo-noise code 211 is '01011010' then the transmitted signal 212 is '01011010 10100101 01011010.' This transmitted signal is created by '1' corresponding to the pseudo-noise code 211 ('010110101') and '0' corresponding to the inverse of the pseudo-noise code ('10100101').

Figure 2(b) is a diagram of an exemplary method of spreading a signal using codebook indexing. As described above, the information signal 210 is again modulated by a spreading signal to create a transmitted signal 214. However, in this case, instead of using a pseudo-noise code, codebook indexing is used. By using codebook indexing, multiple bits of information can be transmitted per pseudo-noise code instead of a single bit, as described above. In codebook indexing, the position of the pseudo-noise code is used to encode multiple bits of information within the pseudo-noise code sent. Therefore, if two bits of information are to be sent per pseudo-noise code, a codebook with four entries is required because two bits of

information have four possible values, where the value ranges from zero to three. If the value of the information bits is 3 (the bits are '11'), then the fourth pseudo noise code, the one is position '11', contained within the codebook is used. In Figure 2(b), the same information signal 210 ('101') of Figure 2(a) is used. In this case, since a binary '101' equals a numeric 5, the sixth pseudo-noise code contained within the codebook, the one is position '101' is used. Assuming that this pseudo-noise code 211 '01011010,' then the transmitted signal is the pseudo-noise code of '01011010.'

Figure 3 is a diagram of an exemplary pseudo-noise table 300 where the table is broken into multiple codebooks. This table has 16 rows, row 0-15. User #1 (301) is assigned the first codebook 311. This codebook 311 contains the pseudo-noise codes contained within table positions 0-3, which are pseudo-noise codes A, B, C and D. User #2 (302) is assigned the second codebook 312. Codebook #2 (312) contains the pseudo-noise codes contained within table positions 4-7, which are pseudo-noise codes E, F, G and H. Finally, User #3 (303) is assigned the third codebook 313. Codebook #3 (313) contains pseudo-noise codes contained within table positions 8-15, which are pseudo noise codes I-P. In this example, codebook #1 (311) and codebook #2 (312) each contained four rows, thus, user #1 (301) and user #2 (302) are each assigned four rows. However, codebook #3 (313) contains eight rows, thus, user #3 (303) is assigned eight rows. As shown here, the number of rows contained within each codebook does not have to be equal, however, the number of rows contained within each codebook needs to be a power of 2 (i.e. 2, 4, 8, 16, 32, 64, etc.). Codebook #1 (311) contains four rows, therefore two bits of data may be sent per each pseudo-noise code. This is the case because to describe four rows, two bits are needed. Since codebook #3 (313)

contains eight rows, which requires three bits to describe all eight rows, three bits of data may be sent per each pseudo-noise code contained within codebook #3 (313).

Figure 4 shows an example of how to use the codebooks of the table of figure 3 to send multiple bits of data per each pseudo-noise code. If the information signal 401 is '10' and is for the first user, the pseudo-noise code contained within the first codebook at position '2' (or '10') within that codebook is used. This corresponds to pseudo-noise code C, therefore, the transmitted signal 403 is pseudo-noise code C. Similarly, if the information signal 404 is '10' and is for the second user, the pseudo-noise code contained within the second codebook at position '2' within the codebook is used. This corresponds to pseudo-noise code G, therefore, the transmitted signal 406 is pseudo-noise code G. Finally, in the case of signals for the third user, three bits of information can be sent per pseudo-noise code. Therefore, if the information signal 407 for user #3 is '010' the pseudo-noise code contained within the third codebook at position '2' is used. This corresponds to pseudo-noise code K, therefore, the transmitted signal 409 is pseudo-noise code K.

CLAIMS

What is claimed is:

1. A method for achieving high bit densities in a direct-sequence CDMA spread spectrum communication system, the method comprising the steps of:

storing a table of orthogonal pseudo-noise codes;

partitioning the table of orthogonal pseudo-noise codes into at least one codebook;

assigning a first codebook to a first user;

spreading a first information signal for the first user with a first pseudo-noise code contained within the first codebook.

2. The method of claim 1 wherein the location of the first pseudo-noise code within the first codebook corresponds to the value of the first information signal for the first user.

3. The method of claim 1 further comprising the step of:

spreading a second information signal for the first user with a second pseudo-noise code contained within the first codebook.

4. The method of claim 3 wherein the location of the second pseudo-noise code within the first codebook corresponds to the value of the second information signal for the first user.

5. The method of claim 1 further comprising the steps of:

assigning a second codebook to a second user;

spreading a first information signal for the second user with a first pseudo-noise code contained within the second codebook.

6. The method of claim 5 further comprising the step of:

spreading a second information signal for the second user with a second pseudo-noise code contained within the second codebook.

7. The method of claim 6 wherein the location of the second pseudo-noise code within the second codebook corresponds to the value of the second information signal for the second user.

8. The method of claim 1 further comprising the step of:

despreading the first information signal for the first user with the first pseudo-noise code within the first codebook.

9. The method of claim 8 wherein the location of the first pseudo-noise code within the first codebook corresponds to the value of the first information signal.

10. The method of claim 1 wherein the partitioning the table of the orthogonal pseudo-noise codes further comprises the step of:

partitioning the table into codebooks such that there are 2^n entries, where n is a whole number.

11. The method of claim 1 wherein a single pseudo-noise code is capable of transmitting multiple bits of information signal.

Docket No. 50R5000

ABSTRACT

A method for achieving high bit densities in a direct-sequence CDMA spread spectrum communication system. A table of orthogonal pseudo-noise codes is stored. This table is then partitioned into multiple codebook. Then, the codebook is assigned to a user. The pseudo-noise code contained within the codebooks are used to spread information signal. Information signal for a first user is spread by a pseudo-noise code contained within the codebook assigned to the first user. Multiple bits of information signal may be sent at a time by using the location of the pseudo-noise code within the codebook such that the value of the information signal corresponds the location of the pseudo-noise code within the codebook. The information signal is then despread by using the same pseudo-noise code.

Docket No. 50269-0169

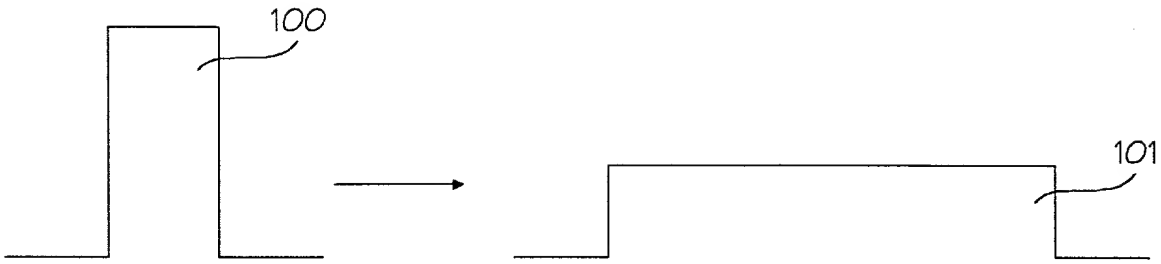

Fig. 1(a)

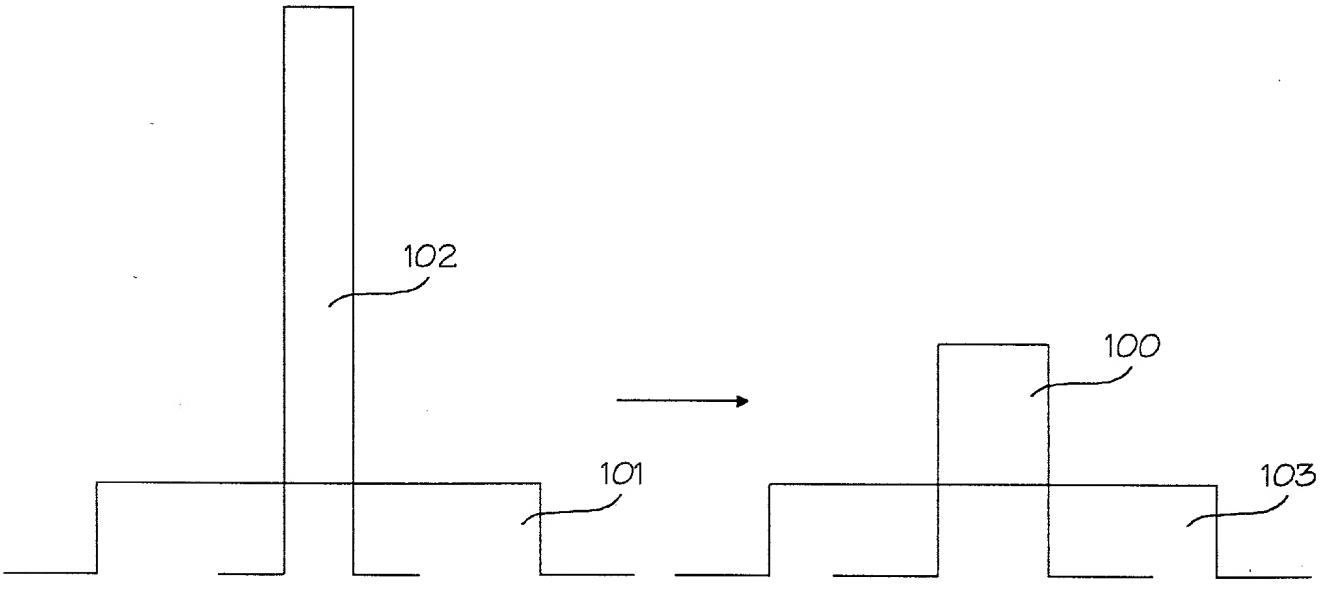

Fig. 1(b)

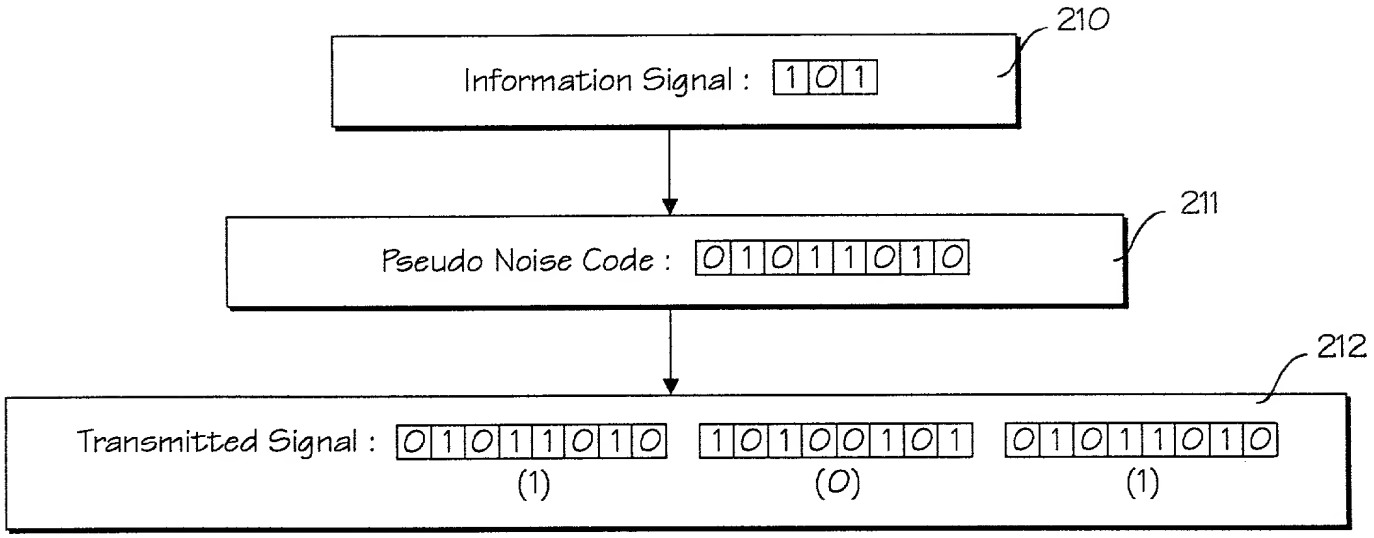

Fig. 2(a)
(Prior Art)

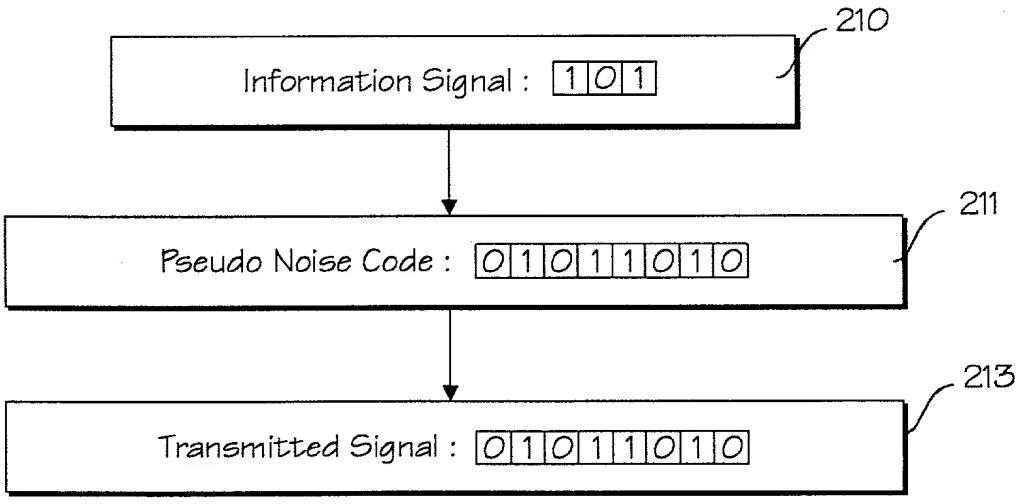

Fig. 2(b)

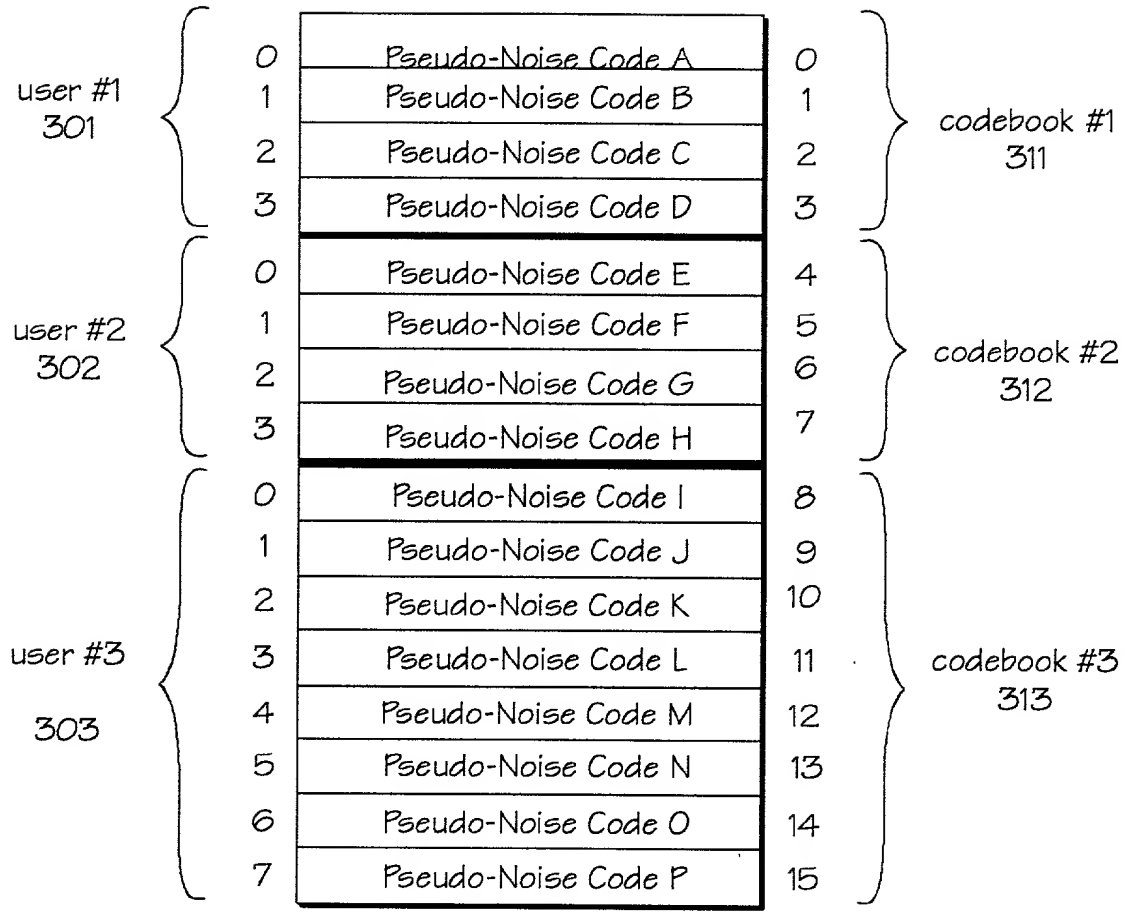
user #1
301
user #2
302
user #3
303
0
1
2
3
0
1
2
3
0
1
2
3
4
5
6
7
Pseudo-Noise Code A
Pseudo-Noise Code B
Pseudo-Noise Code C
Pseudo-Noise Code D
Pseudo-Noise Code E
Pseudo-Noise Code F
Pseudo-Noise Code G
Pseudo-Noise Code H
Pseudo-Noise Code I
Pseudo-Noise Code J
Pseudo-Noise Code K
Pseudo-Noise Code L
Pseudo-Noise Code M
Pseudo-Noise Code N
Pseudo-Noise Code O
Pseudo-Noise Code P
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
codebook #1
311
codebook #2
312
codebook #3
313
300

Fig. 3

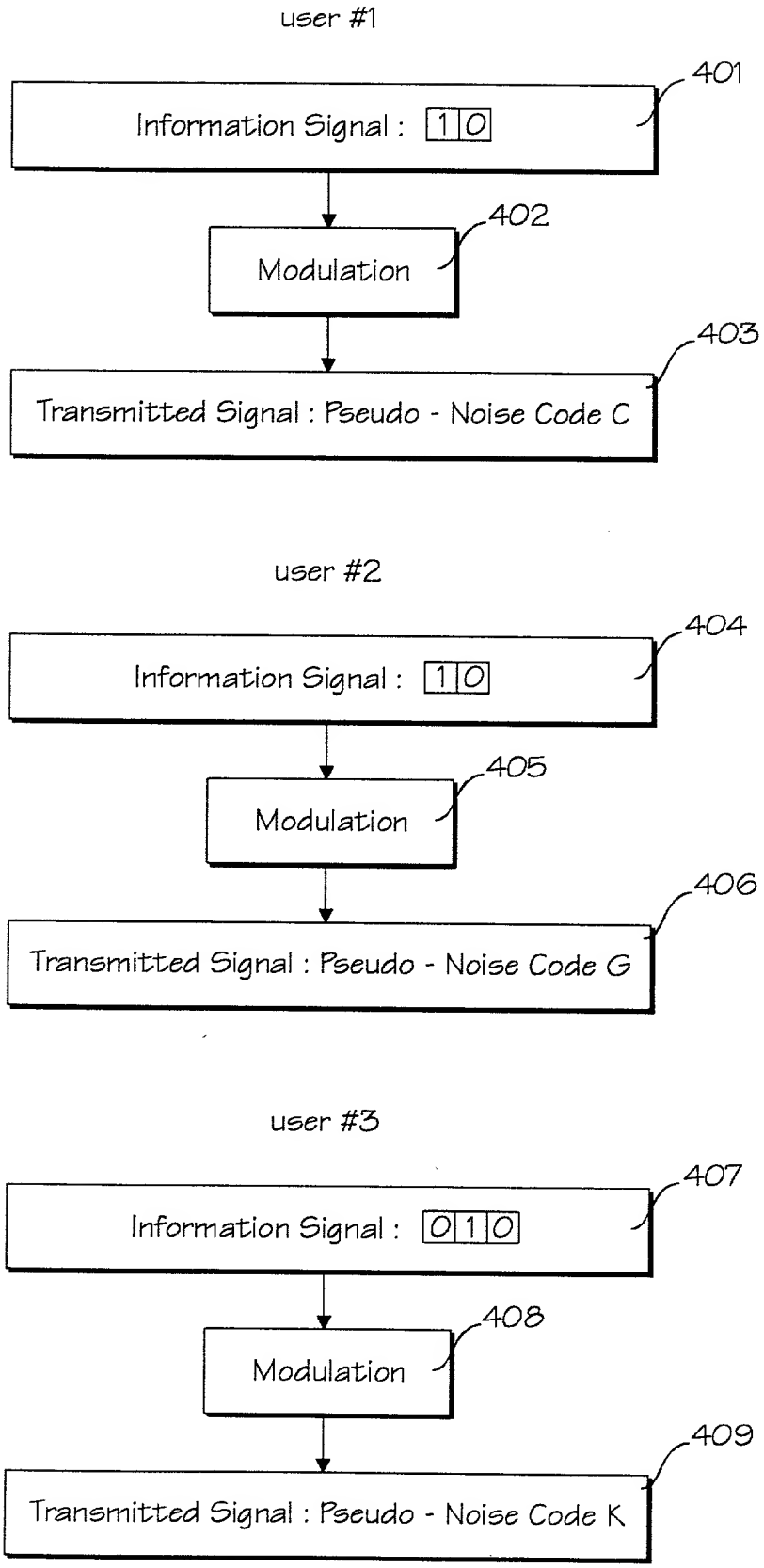
user #1
Information Signal : 1 0
401
Modulation
402
Transmitted Signal : Pseudo - Noise Code C
403
user #2
Information Signal : 1 0
404
Modulation
405
Transmitted Signal : Pseudo - Noise Code G
406
user #3
Information Signal : 0 1 0
407
Modulation
408
Transmitted Signal : Pseudo - Noise Code K
409

Fig. 4

Attorney's Docket No.: 42390.P5112 PATENT

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION
(FOR **INTEL CORPORATION** PATENT APPLICATIONS)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

A METHOD FOR USING CODEBOOK INDEXING TO ACHIEVE HIGH BIT DENSITIES IN A DIRECT-SEQUENCE SPREAD CDMA SPECTRUM COMMUNICATION SYSTEM

the specification of which

___X___ is attached hereto.
_____ was filed on _____ as
United States Application Number _____
or PCT International Application Number_____
and was amended on _____.
(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above. I do not know and do not believe that the claimed invention was ever known or used in the United States of America before my invention thereof, or patented or described in any printed publication in any country before my invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months (for a utility patent application) or six months (for a design patent application) prior to this application.

I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed	
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No

I hereby claim the benefit under title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below

(Application Number)	Filing Date
(Application Number)	Filing Date

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Number)	Filing Date	(Status -- patented, pending, abandoned)
(Application Number)	Filing Date	(Status -- patented, pending, abandoned)

0508.74.2.0.0

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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PATENT

Title 37, Code of Federal Regulations, Section 1.56
Duty to Disclose Information Material to Patentability

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclosure information exists with respect to each pending claim until the claim is cancelled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is cancelled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclosure all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

(1) Prior art cited in search reports of a foreign patent office in a counterpart application, and

(2) The closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made or record in the application, and

(1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or

(2) It refutes, or is inconsistent with, a position the applicant takes in:

(i) Opposing an argument of unpatentability relied on by the Office, or

(ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

(1) Each inventor named in the application;

(2) Each attorney or agent who prepares or prosecutes the application; and

(3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.